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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/876,742	06/07/2001	Toshiyuki Miyauchi	450100-03274	1867

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EXAMINER	
TORRES, JOSEPH D	
ART UNIT	**PAPER NUMBER**
2133	

DATE MAILED: 10/12/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/876,742	MIYAUCHI ET AL.	
	Examiner	Art Unit	
	Joseph D. Torres	2133	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 August 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-48* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-48* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *11 August 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. In view of the Applicant's Amendment filed 11 August 2004, The Examiner withdraws all objections to the drawings.

Claim Objections

2. In view of the Applicant's Amendment filed 11 August 2004, The Examiner withdraws all previous objections to the claims.

Specification

The disclosure is objected to because of the following informalities:

Claims 1 and 25 recite, "a decoding state". Nowhere in the specification does the Applicant even mention the term "decoding state".

Claims 1 and 25 recite, "getting to a state in the decoder". Nowhere in the specification does the Applicant even mention the term "getting to a state in the decoder".

Claims 1 and 25 recite, "an input value from an encoder encoded with a trellis". Nowhere in the specification does the Applicant even mention the term "an input value from an encoder encoded with a trellis".

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1-48 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Claims 1 and 25 recite, "a decoding state". Nowhere in the specification does the Applicant even mention the term "decoding state".

Claims 1 and 25 recite, "getting to a state in the decoder". Nowhere in the specification does the Applicant even mention the term "getting to a state in the decoder".

Claims 1 and 25 recite, "an input value from an encoder encoded with a trellis". Nowhere in the specification does the Applicant even mention the term "an input value from an encoder encoded with a trellis".

Claims 2-24 and 26-48 depend from respective claims 1 and 25, hence inherit the deficiencies of claims 1 and 25.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1-48 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1 and 25 recite, "said input value is regarded as being a soft value". It is not clear whether the input values is a soft value or not.

Claims 1-48 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. Claims 1 and 25 recite, "log likelihood of getting to a state in the decoder". The omitted structural cooperative relationships are: the relationship between "log likelihood" and "a state in the decoder".

Claims 1 and 25 recite, "an input value from an encoder encoded with a trellis". The omitted structural cooperative relationships are: the relationship between "an input value from an encoder" and "a trellis".

Claims 1 and 25 recite, "said input value is regarded as being a soft value". The omitted structural cooperative relationships are: the relationship between "said input value" and "a soft value".

Claims 2-24 and 26-48 depend from respective claims 1 and 25, hence inherit the deficiencies of claims 1 and 25.

The claims are generally narrative and indefinite, failing to conform with current U.S. practice. They appear to be a literal translation into English from a foreign document and are replete with grammatical and idiomatic errors.

The claims include terminology, which is so different from that which is generally accepted in the art to which this invention pertains that a proper search of the prior art cannot be made. For example: Claims 1 and 25 recite, "a decoding state". Claims 1 and 25 recite, "getting to a state in the decoder". Claims 1 and 25 recite, "an input value from an encoder encoded with a trellis".

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. Claims 1-3, 14, 25-27 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Van Stralen, Nick Andrew et al. (US 6304996 B1, hereafter referred

to as Van Stralen) in view of Shiu; Da-shan et al. (US 6392572 B1, hereafter referred to as Shiu).

35 U.S.C. 103(a) rejection of claims 1 and 25.

Van Stralen teaches a path selection means for obtaining at least two paths of getting to a decoding state from at least three paths (Claim 1 in Van Stralen teaches an alpha block for receiving a plurality of alpha probability function values for partial forward paths and for recursively calculating alpha probability function values for partial forward paths; Claim 1 in Van Stralen teaches an beta block for receiving a plurality of beta probability function values for partial backward paths and for recursively calculating beta probability function values for partial backward paths; Note: the calculated alpha and beta probability function values for partial forward and backward paths are at least two paths of getting to a decoding state obtained from at least three paths, i.e., the received plurality of alpha and beta probability function values for partial forward and backward paths), and for selecting a maximum likelihood path from said at least two paths (Switches 54 and 56 in Figure 4A in Van Stralen are alpha path selection means for obtaining at least two or more alpha paths showing a high likelihood out of the at least three or more alpha paths for getting to each state and selecting the maximum likelihood alpha path from the obtained at least two or more alpha paths; Switches 54 and 56 in Figure 4B in Van Stralen are beta path selection means for obtaining at least two or more beta paths showing a high likelihood out of the at least three or more beta paths for getting to each state and selecting the maximum likelihood beta path from the

obtained at least two or more beta path: Note: the alpha and beta recursion update circuits of Figure 4A and 4B are replicated various times for use in Figure 3 in Van Stralen: Note also, the Abstract in Van Stralen teaches that the decoder in the Van Stralen patent are for implementing a standard maximum a posterior, MAP, algorithm), wherein a log likelihood of getting to a state in the decoder is determined by an input value from an encoder encoded with a trellis so as to provide at least three paths for getting to the decoding state (Figure 4A and 4B teach log likelihoods are used as forward and backward alpha and beta path metrics; Note: any Trellis has a multitude of paths for getting to any state in the trellis). Note: The Abstract in Van Stralen teaches that the MAP decoder in Van Stralen is a sof output decoder.

However Van Stralen does not explicitly teach the specific use of said input value received through a communication channel having noise such that said input value is regarded as being a soft value.

Shiu, in an analogous art, teaches the use of Soft-Input/Soft-Output SISO decoding (col. 6, lines 41-43 in Shiu; Note: soft input is an input value received through a communication channel having noise such that said input value is regarded as being a soft value since it is a soft value). Note: SISO decoding is one of the more common means for MAP decoding in a Turbo decoder because of the additional information that soft symbols provide.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Van Stralen with the teachings of Shiu by including use of Soft-Input/Soft-Output SISO dec. This modification would have been obvious to one of

ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that use of Soft-Input/Soft-Output SISO dec would have provided the opportunity to take advantage of the additional information that soft symbols provide.

35 U.S.C. 103(a) rejection of claims 2 and 26.

Comparator 78 in Figure 5C of Van Stralen is comparison means for comparing the likelihoods of all the combinations of two paths selected from all the three or more than three paths getting to each state (Note: Figure 5C is a block diagram of the Log Addition circuits 67 in Figure 5A of Van Stralen). Also see col. 9, lines 10-22 of Van Stralen for details.

35 U.S.C. 103(a) rejection of claims 3 and 27.

Absolute Value circuit 106 in Figure 8A in Van Stralen is an absolute value selection means for selecting the absolute value of the difference between the data corresponding to the maximum likelihood path and the data corresponding the second maximum likelihood path.

35 U.S.C. 103(a) rejection of claims 14 and 38.

The log-MAP algorithm taught in Van Stralen is based on the natural logarithm (see Abstract of Van Stralen).

6. Claims 4, 5, 15-24, 28, 29 and 39-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Van Stralen, Nick Andrew et al. (US 6304996 B1, hereafter referred to as Van Stralen) and Shiu; Da-shan et al. (US 6392572 B1, hereafter referred to as Shiu) in view of Benedetto et al. (S. Benedetto, D. Divsalar, G. Montorsi, and F. Pollara, Soft-Output Decoding Algorithms in Iterative Decoding of Turbo Codes, TDA Progress Report 42-124, NASA Code 315-91-20-20-53).

35 U.S.C. 103(a) rejection of claims 4 and 28.

Van Stralen and Shiu, substantially teaches the claimed invention described in claims 1-3, 14, 25-27 and 38 (as rejected above). In addition, Absolute Value circuit 106 in Figure 8A in Van Stralen is an absolute value selection means having an absolute value computing means for computing the absolute value of the difference of each of all the combinations of two paths selected from all the three or more than three paths getting to each state. Comparator 78 in Figure 5C of Van Stralen is a means for comparing the magnitude of the computed values

However Van Stralen and Shiu, does not explicitly teach the specific use of **the computed absolute values being compared for magnitude** on the basis of the information on the outcome of comparison obtained by comparing the likelihood of each of all the combinations of two paths selected from all the three or more than three paths getting to each state by means of said path selection means.

Benedetto et al. (hereafter referred to as Benedetto), in an analogous art, teach that both Approximation Algorithms 1 and 2 require comparison steps for the absolute value

(Page 86 of Benedetto; Note in Approximation 1, the absolute value, x, is compared to 0 and b/a and in Approximation 2, the absolute value, x, is compared to η). One of ordinary skill in the art at the time the invention was made would have been highly motivated to employ the approximation methods in the Benedetto paper to simplify the calculation to the log likelihood term required by the MAP algorithm.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Van Stralen and Shiu with the teachings of Benedetto by including use of the computed absolute values being compared for magnitude. This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that use of the computed absolute values being compared for magnitude would provide the opportunity to simplify the calculation of the log likelihood term required by the MAP algorithm.

35 U.S.C. 103(a) rejection of claims 5 and 29.

Note: Approximation Algorithm 1 in Benedetto is a linear approximation means computing by linear approximation a correction term added to obtain said log likelihood and expressed by a one-dimensional function relative to a variable and the variable, x, is the absolute value of the difference between the data corresponding to said maximum likelihood path and fed from said absolute value selection means and the data corresponding to said second maximum likelihood path (Page 86 of Benedetto).

35 U.S.C. 103(a) rejection of claims 15, 16, 39 and 40.

Benedetto teaches a first probability computing means for computing for each received value a first log likelihood logarithmically expressing a first probability determined by the code output pattern and said received value (log-BCJR 1 Decoder in Figure 6 on page 79 of Benedetto is a first probability computing means for computing for each received value a first log likelihood logarithmically expressing a first probability determined by the code output pattern and said received value); a second probability computing means for computing for each received value a second log likelihood logarithmically expressing a second probability of getting to each state from the coding starting state in the time series (log-BCJR 2 Decoder in Figure 6 on page 79 of Benedetto is a second probability computing means for computing for each received value a second log likelihood logarithmically expressing a second probability of getting to each state from the coding starting state in the time series); a third probability computing means for computing for each received value a third log likelihood logarithmically expressing a third probability of getting to each state from the coding terminating state in the inverted time series (log-BCJR 3 Decoder in Figure 6 on page 79 of Benedetto is a third probability computing means for computing for each received value a third log likelihood logarithmically expressing a third probability of getting to each state from the coding terminating state in the inverted time series); and said second probability computing means and said third probability computing means having path selection means (see Approximation 1 on page 86 of Benedetto and selection circuits in Figures A-1 and A-2 in Benedetto).

35 U.S.C. 103(a) rejection of claims 17 and 41.

The log-BCJR MAP algorithm is based on the natural logarithm (see Approximation 1 on page 86 of Benedetto).

35 U.S.C. 103(a) rejection of claims 18 and 42.

Note: the Absolute Value circuit 106 in Figure 8A in Van Stralen is an absolute value selection means for selecting the absolute value of the difference between the data corresponding to the maximum likelihood path and the data corresponding the second maximum likelihood path replicated in each of the Update Alpha/Beta Recursion circuits of Figure 3 in Van Stralen; hence Van Stralen teaches said second probability computing means and said third probability computing means have absolute value selection means for determining the absolute value of the difference between the data corresponding to the maximum likelihood path and the data corresponding to the second maximum likelihood path showing the second highest likelihood, respectively.

35 U.S.C. 103(a) rejection of claims 19 and 43.

Note: Approximation Algorithm 1 in Benedetto is a linear approximation means computing by linear approximation a correction term added to obtain said log likelihood and expressed by a one-dimensional function relative to a variable and the variable, x, is the absolute value of the difference between the data corresponding to said maximum likelihood path and fed from said absolute value selection means and the data corresponding to said second maximum likelihood path (Page 86 of Benedetto).

35 U.S.C. 103(a) rejection of claims 20, 22, 44 and 46.

The equation, -ax+b, on page 86 of Benedetto is a computation means for replacing the multiplications for computing the probability by logarithmic additions and the additions for computing the probability by logarithmic maximum value computations and computations of said function.

35 U.S.C. 103(a) rejection of claims 21, 23, 45 and 47.

The maximum a posteriori probability decoding operation in Benedetto is conducted on the basis of the Log-BCJR algorithm (see Approximation 1 on page 86 of Benedetto).

35 U.S.C. 103(a) rejection of claims 24 and 48.

Figure 1 on page 64 of Benedetto teaches convolutional codes.

7. Claims 6, 9, 10, 12, 13, 30, 33, 34, 36 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Van Stralen, Nick Andrew et al. (US 6304996 B1, hereafter referred to as Van Stralen), Shiu; Da-shan et al. (US 6392572 B1, hereafter referred to as Shiu)and Benedetto et al. (S. Benedetto, D. Divsalar, G. Montorsi, and F. Pollara, Soft-Output Decoding Algorithms in Iterative Decoding of Turbo Codes, TDA Progress Report 42-124, NASA Code 315-91-20-20-53) in view of XP-000888685 ("Simplified Log-Map Algorithm", Research Disclosure, Kenneth Mason Publications,

Hampshire, GB, No. 421, May 1999, Page 612, ISSN: 0374-4353: Note this publication was provided by the Applicant in US Application 09/875310).

35 U.S.C. 103(a) rejection of claims 6 and 30.

Van Stralen, Shiu and Benedetto et al. (hereafter referred to as Benedetto), substantially teaches the claimed invention described in claims 1-5,14-29 and 38-48 (as rejected above). In addition, Benedetto teaches a decoder for determining the log likelihood logarithmically expressing the probability of passing a given state on the basis of the received value regarded as soft-input and decoding the input by using the log likelihood (the Abstract, Appendix and Figures 6, A-1 and A-2 in Benedetto teach a decoder for determining the log likelihood logarithmically expressing the probability of passing a given state on the basis of the received value regarded as soft-input and decoding the input by using the log likelihood), said decoder comprising: a linear approximation means for calculating a correction term to be added to the log likelihood (Approximation 1 on page 86 of Benedetto teaches a linear approximation means, -ax+b, for calculating a correction term to be added to the log likelihood), the correction term being expressed in a one-dimensional function relative to a variable (in Approximation 1 on page 86 of Benedetto, -ax+b is a one-dimensional function relative to the variable x); and said linear approximation means being adapted to compute said correction term using a coefficient representing the gradient of said function for multiplying said variable (see Approximation 1 on page 86 of Benedetto; Note: a represents the one-dimensional gradient of the function, -ax+b).

However Van Stralen, Shiu and Benedetto, do not explicitly teach the specific use of the coefficient being expressed as a power exponent of 2.

Document XP-000888685, in an analogous art, teaches that B = 4 = 2^2, hence a in Benedetto =2^{-2} since a in Benedetto = 1/B. Document XP-000888685 provides explicit motivation for combining stating that "...B = 4 achieves performance that is very close to exact implementation".

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Van Stralen, Shiu and Benedetto with the teachings of Document XP-000888685 by including use of the coefficient being expressed as a power exponent of 2. This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that use of the coefficient being expressed as a power exponent of 2 would have provided the opportunity to achieve performance that is very close to exact implementation (see the last paragraph of the first page of Document XP-000888685).

35 U.S.C. 103(a) rejection of claims 9, 10, 33 and 34.

Selection of a particular value for b in the equation, -ax+b, is a particular embodiment of the equation, hence does not deviate from the scope or intent of the teachings in the Benedetto paper.

35 U.S.C. 103(a) rejection of claims 12 and 36.

|x-y| in the equation A – (|x-y|/B) of Document XP-000888685 is a positive value, hence Document XP-000888685 teaches said correction term shows a positive value. Note also, this is consistent with the Benedetto paper since the Benedetto paper requires x > 0.

35 U.S.C. 103(a) rejection of claims 13 and 37.

Document XP-000888685 teaches $(A - (|x-y|/B))_+ = A - (|x-y|/B)$ when $A - (|x-y|/B) > 0$ and $(A - (|x-y|/B))_+ = 0$ when $A - (|x-y|/B) \leq 0$.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joseph D. Torres whose telephone number is (703) 308-7066. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Albert Decady can be reached on (703) 305-9595. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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